MERRIMACK RIVER BASIN BRISTOL, NEW HAMPSHIRE

# NEWFOUND LAKE DAM NH 00137

# PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM



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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS, 02154

OCTOBER 1978

SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM	
I. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER	
NH 00137			
4. TITLE (and Subtitio)		5. TYPE OF REPORT & PERIOD COVERED	
Newfound Lake Dam		INSPECTION REPORT	
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		6. PERFORMING ORG, REPORT NUMBER	
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(#)	
U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION			
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE October 1978	
		13. NUMBER OF PAGES	
4. MONITORING AGENCY NAME & ADDRESS(It different from Controlling Office)		15. SECURITY CLASS. (of this report)	
		UNCLASSIFIED	
		184. DECLASSIFICATION/DOWNGRADING	

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

#### 18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY.

Merrimack River Basin Bristol, New Hampshire Newfound River

20. AMSTRACY (Continue on reverse side if necessary and identify by block number)

The dam is a concrete masonry and timber dam structure founded on a timber crib. It is 117 ft. long and 12 ft. high. The overall condition of the dam is good as a result of a rehabilitation and modification completed in 1977. Preliminary analysis indicate the spillway has a capacity to pass only 19 percent of the spillway design flood (SDF), which in this case is the PMF.

#### DEPARTMENT OF THE ARMY



## NEW ENGLAND DIVISION, CORPS OF ENGINEERS **424 TRAPELO ROAD**

WALTHAM, MASSACHUSETTS 02154

REPLY TO ATTENTION OF:

NEDED -

SEP 24 1979

Honorable Hugh J. Gallen Governor of the State of New Hampshire State House Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Newfound Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire and owner of the project.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

Inc1

As stated

MAX B. SCHEIDER

Colonel, Corps of Engineers

Division Engineer

## NEWFOUND LAKE DAM NH 00137

MERRIMACK RIVER BASIN
BRISTOL, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

#### PHASE I REPORT

#### NATIONAL DAM INSPECTION PROGRAM

Name of Dam:

Newfound Lake Dam, I.D., NH 00137

State Located:

New Hampshire

County Located:

Grafton

Town Located:

Bristol

Stream:

Newfound River

Date of Inspection:

June 5, 1978

#### BRIEF ASSESSMENT

Newfound Lake Dam is a concrete masonry and timber dam structure founded on a timber crib. The dam which is 117-ft. in length and 12-ft. in height, consists of three sections: a timber dam built at the right abutment, an adjacent sluice gate section and a newly built stop plank section at the left abutment. The dam has a spillway length of 43 ft.-6 in. on the timber dam plus 13-ft. on the new stop plank section for a total length of 56-ft.-6 in.

The overall physical condition of Newfound Lake Dam is good as a result of a rehabilitation and modification completed in 1977.

Preliminary analyses indicate the spillway has capacity to pass only 19 percent of the Spillway Design Flood (SDF), which in this case is the Probable Maximum Flood (PMF). However, more detailed hydraulic studies of the channel upstream and downstream of the dam are needed to determine relationships between water levels at the lake versus those at the dam and the effect of possible submergence at the dam by backwater during major floods. Recommended actions to be carried out by the owner, within 24 months after

recipt of this Phase I Report, are summarized in Section 7. The most important of these is the acquisition of sufficient date to produce a comprehensive as-built set of drawings for the dam and its foundation.



Robert Gershowitz, P.E.

This Phase I Inspection Report on Newfound Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman Chief, Foundation and Materials Branch Engineering Division

FRED J. RAVENS, Jr., Member Chief, Design Branch

Engineering Division

SAUL COOPER, Member Chief, Water Control Branch Engineering Division

APPROVAL RECOMMENDED:

Chief, Engineering Division

#### PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

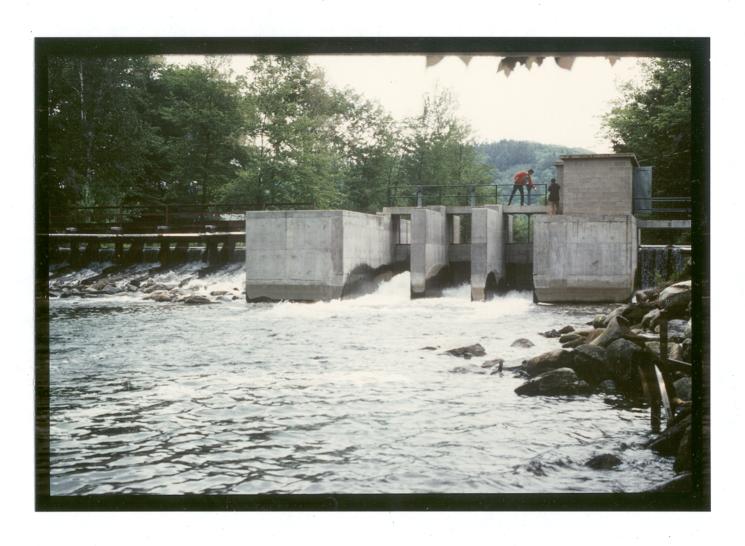
It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe condition be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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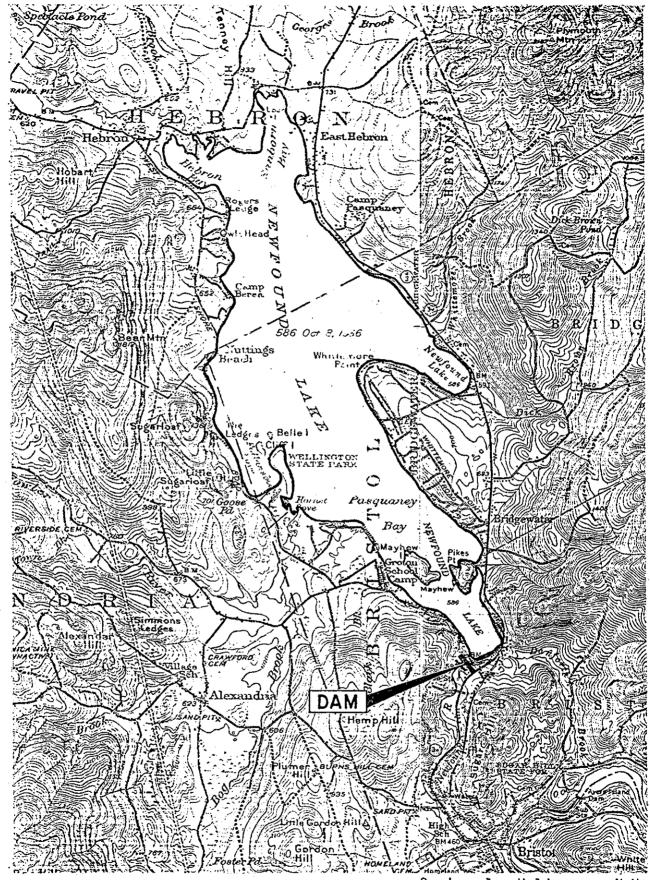
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N E W F O U N D L A K E D A M

General view of the dam from downstream



Quadrangle: Holderness, N.H. VICINITY MAP Scale: 1" = 2000'

#### PHASE I INSPECTION REPORT NEWFOUND LAKE DAM NH 00137

#### SECTION 1

#### PROJECT INFORMATION

#### 1.1 General

a. <u>Authority</u>. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. HARRIS-ECI ASSOCIATES has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed was issued to HARRIS-ECI ASSOCIATES under a letter of June 7, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0305 has been assigned by the Corps of Engineers for this work.

#### b. Purpose

- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.
- (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.
- (3) To update, verify and complete the National Inventory of Dams.

#### 1.2 Description of Project

#### a. Location

The dam is located on the Newfound River approximately 500 feet down-stream along the river channel outlet of Newfound Lake in the Town of Bristol, Grafton County, New Hampshire. The Newfound River is a tributary of the Pemigewasset River, and is part of the Merrimack River primary drainage basin.

#### b. <u>Description of Dam and Appurtenances</u>

Newfound Lake Dam is a concrete masonry and timber dam structure founded on a timber crib. The dam consists of three distinct sections. A timber dam, approximately 48-foot long, is built at the right abutment terminating at a concrete or masonry abutment wingwall. This timber dam has 12 sets of stop plank openings approximately 3 ft.-6 in. wide. On the left, the timber dam is separated from an adjacent sluice gate section by a massive concrete faced masonry pier approximately 13.5-foot wide. The sluice gate section contains three 6 by 6-foot timber sluice gates operated manually or by portable electric drill power. The sluice gate section is separated on the left from an adjacent newly built stop plank section by a massive concrete faced masonry pier 11.5 foot wide on which a gate access house has been built. The stop plank section consists of 2 bays approximately 4.67-foot wide by 6.7-foot deep below the full lake elevation of 589.1. The stop plank section terminates at the left abutment wingwall.

The dam is founded on a timber crib set into the river channel. The foundation materials on the river bed are believed to be coarse silty gravelly sands.

Newfound Lake has a surface area of 4,410 acres impounding 27,715 acrefeet of water derived from a 95 square mile drainage area. The lake is of natural origin, but its level has been raised by the construction of

the dam. The reservoir rim has been developed with summer cottage type residences along significant parts of its perimeter. The downstream channel of the Newfound River is well defined and unobstructed in the immediate downstream reach. A smaller dam structure downstream of Newfound Dam utilizes lake releases from the dam for power generation.

#### c. Size Classification

According to the "Recommended Guidelines for Safety Inspection" by the U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam size category as being "Intermediate", since its storage is more than 1,000 acre-feet but less than 50,000 acre-feet. The dam is classified as "Small" because its height is less than 40 feet. The overall size classification is the larger of these two classifications, and accordingly Newfound Lake Dam is classified as "Intermediate" in size.

#### d. Hazard Classification

The dam has been listed in the National Inventory of Dams as having High Hazard Potential, on the basis that in the event of failure of the dam and its appurtenances, excessive damage could occur to downstream property together with the possibility of the loss of more than a few lives. The current inspection concurs with this classification because the dam impounds a very large volume of water and is founded on erodible materials. In case of dam operating accident or failure, the downstream community of Bristol would have only approximately 7 to 10 minutes to institute emergency flood evacuation procedures from low lying areas of the community along the stream channel.

#### e. Ownership

The dam is owned by the New Hampshire Water Resources Board (NH-WRB), headquartered at Concord, New Hampshire.

#### f. Operator

The Newfound Lake Dam is operated by the N.H. Water Resources Board, headquartered at Concord, New Hampshire - Telephone: (603) 271-3405.

#### g. Purpose of the Dam

The purpose of the dam is recreation and flood control.

#### h. <u>Design and Construction History</u>

A dam has been located at this particular location since 1840, originally for the regulation of power development downstream. As development around the lake increased, the concern with regulating the lake level has also increased. Power is still being generated at an impounding structure in the downstream river reach. Ownership of the dam passed to NH-WRB in 1974. Ending in 1977, the dam was modified and refurbished by the NH-WRB by the removal of a permanent spillway crest section and replacing it with a 3-bay stop plank section. At the same time, the existing sluice gate section was replaced by a new one containing three 6 by 6-foot sluice gates. The existing masonry piers between the timber dam and the sluice gates and between the sluice gates and the stop plank section were resurfaced with reinforced concrete. The left abutment masonry wingwall was also resurfaced and a cutoff wall section tying into the abutment was added at the upstream end of the wingwall. No construction history of the timber structure on the right abutment was uncovered in available NH-WRB records. Parts of the masonry and timber crib foundation date to the original dam construction in 1846.

#### i. Normal Operating Procedures

Newfound Lake Dam is operated by the NH-WRB for recreation and flood control purposes. The lake level is very closely monitored by an automatic level recording device combined with telephonic data transmission to the NH-WRB headquarters in Concord. The lake level is considered

"flashy" by the NH-WRB dam operator, meaning that the lake level can show wide variations after normal amounts of precipitation falling on its watershed. The summer cottage residents along the shore are very sensitive to water level fluctuations, and frequently low and high water complaints are received at the same time.

In the summer time, the water level is regulated at 6.5 feet as measured on the staff gage at the lake's natural outlet corresponding to 588.38 MSL. In the past few years, the summer time level has been kept below the normal full lake level (7.24 gage, 589.12 MSL), at the request of summer residents. During the summer months, the lake level is gradually lowered by the requirement to maintain a minimum downstream release of 45 cubic feet per second. The targeted lake elevation by the end of the summer on Labor Day is 5.0 gage or Elevation 586.88 MSL. After Labor Day, a rapid drawdown of the lake to its winter elevation of  $3.5^{\pm}$  gage or Elevation 585.38 MSL is made, arriving at that level by mid-October. An attempt is made to hold this winter time level until springtime, when snowmelt inflows once again raise the lake to its summer elevation at the beginning of June.

#### 1.3 Pertinent Data

Drainage Area a.

95 square miles

Discharge at Dam Site b.

Maximum known flood at dam site:

1,840 cfs in the period since the reconstruction of dam or 1977-1978

Warm water outlet at pool elevations:

NA

Diversion tunnel low pool outlet at pool elevation:

NA

Diversion tunnel outlet at pool elevation:

NA

Gated spillway capacity at pool elevation:

NA

Gated spillway capacity at maximum pool elevation:

NA

Ungated spillway capacity at maximum pool elevation:

500 cfs, all stop planks in place 588.4 & pool at Elev. 589.1 to Elev.

Total spillway capacity at maximum pool elevation:

As above

Elevation (Feet above MSL)

Top of dam:

Elev. 592.1

Maximum pool design surcharge:

589.1

Full flood control pool:

NA

Recreation pool:

Elev. 588.4 Elev. 588.4

Flashboards in place

Spillway crest:

NA

Upstream portal invert diversion

tunnel:

NΑ

Downstream at centerline diversion tunnel:

Streambed at centerline of dam:

Elev. 580

Maximum tailwater:

Unknown

d. Reservoir

Length of maximum pool:

6.30 miles (estimated)

Length of recreation pool:

6.16 miles (estimated)

Length of flood control pool:

NA

e. Storage (acre-feet)

Recreation pool:

24,557 AF, Elev. 588.4

Flood control pool:

NA

Design surcharge:

27,715 AF, Elev. 589.1

Top of dam:

41,244 AF

f. Reservoir Surface (acres)

Top of dam:

4,670 A

Maximum pool:

4,410 A

Flood control pool:

NA

Recreation pool:

4,360 A

Spillway crest:

4,360 A

g. Dam

Type:

Masonry and concrete gravity dam with

a timber section

Length:

117 feet

Height:

12 feet

Top width:

Varies

Side Slopes - Upstream:

- Downstream:

Not applicable

Zoning:

Impervious core:

Not applicable

Cutoff:

Not applicable

Grout curtain:

None

h. <u>Diversion and Regulatin</u>	g Tunnel		
Type:	NA		
Length:	NA		
Closure:	NA		
Access:	NA		
Regulating facilities:	NA		
i. Spillway			
Type:	Stop plank sections		
Length of weir:	) Total length 43'-6" net on timber dam ) plus 13'-0" on new stop plank section ) for a total of 56'-6"		
Crest elevation:	588.4, stop planks in place		
Gates:	None		
U.S. Channel:	Newfound River		
D/S Channel:	Timber plank and concrete apron, Newfound River		
j. Regulating Outlets			
Low level outlet:	3 passes, each 6 x 6 feet		
Controls:	Timber sluice gates, hoist operated		
Emergency gate:	Provisions for stop planks on upstream side		
Outlet:	Concrete apron slab		

#### SECTION 2

#### ENGINEERING DATA

#### 2.1 Design

A partial set of drawings of the dam as modified by the N.H. Water Resources Board (NH-WRB) is available. These drawings show details of the reconstruction completed in 1977 consisting of a triple pass sluice gate section containing three 6 x 6-foot sluice gates and a 14-foot wide stop plank section. These drawings are design drawings and do not have as-built modifications marked on them. No drawings are available for the following dam areas:

- (1) The timber dam section on the right abutment.
- (2) Details of the right abutment wingwall.
- (3) Details of the timber crib foundation as uncovered during the reconstruction of the dam in the period 1975-1977.
  - (4) Details of the gate access house.

A partial set of design computations relating to the timber sluice gate structural design was recovered from the NH-WRB files. Discharge ratings for the sluice gates and the new stop plank sections have also been computed. No computations were uncovered in the following areas:

- (1) Structural design or stability of the timber dam sections.
- (2) Stability of the sluice gate or new stop plank sections.
- (3) Tailwater rating curves.

- (4) Foundation criteria or resistive capacity of the existing timber crib section.
  - (5) Seepage analysis through the foundation.

#### 2.2 Construction

No detailed engineering information was recovered from NH-WRB files concerning the reconstruction of the dam in the period 1975-1977.

#### 2.3 Operation

Maximum lake level records exist for Newfound Lake from 1937 onward, but with gaps for the years 1948, 1951, 1952, 1956-1960, 1971, and 1975. The maximum lake level recorded in the years of record is 10.1 gage in July 1973 corresponding to Elevation 591.98 MSL. At present, the top of dam is at 10.23 gage or Elevation 592.11. No data is available on the settings of the stop planks or the gate openings at the dam for this high lake level event. Not enough time has passed to accumulate sufficient operating data and experience with the present dam modification.

#### 2.4 Evaluation

#### a. Availability

The availability of data is fair as far as design is concerned and very deficient as far as construction and operation is concerned. An effort should be made by the owner to assemble more complete documentation.

#### b. Adequacy

The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based

primarily on visual inspection, past performance history and sound engineering judgement.

#### c. Validity

The available drawings on the reconstructed part of the dam appear to relate closely, in general, with the actual structure. The drawings are not marked "as-built" and should be updated and corrected in line with what was actually built. The as-built condition of the timber foundation uncovered during the reconstruction should be added to the available drawing set.

#### SECTION 3

#### VISUAL INSPECTION

#### 3.1 Findings

#### a. <u>General</u>

Newfound Lake Dam, as reconstructed in the period ending in 1977, is in very good condition and does not show any signs of distress. As a result of the recent repairs and modifications, the operating facilities were all in very good condition.

#### b. Dam

The dam can be divided into five main parts:

- (1) Timber dam section
- (2) Sluice gate section
- (3) New Stop plank section
- (4) Abutment wingwalls
- (5) Foundation of the dam
- (1) <u>Timber Dam Section</u>. The timber dam section is built adjacent to the right abutment wingwall. The timber dam is built in 6 bays each approximately 7 ft.-3 in. wide. Each bay contains full depth timber stop planks for control of the lake level. The timber framing is massive 12 x 12 beams posts and braces and the entire structure rests on a sloping timber apron. The toe of the timber apron is protected by medium to large sized riprap stones. A timber walkway surmounts the timber dam, permitting access to the stop planks and their convenient operation. The top surfaces of all main timbers are protected by sheet metal covers to shed water and reduce deterioration due to cyclical wetting and drying. All timber parts appear to be sound and all connections visible were securely joined and showed no signs of distress. The timber structure was well aligned vertically and horizontally and showed no signs of lateral movements or deflections.

(2) Sluice Gate Section. The sluice gate section has been rebuilt in 1977 and is situated between two massive masonry piers separating it from the adjacent timber dam and stop plank sections. masonry piers have been resurfaced with concrete and are in apparent sound condition. No cracking is visible, and the overlay concrete appears soundly attached to the masonry beneath. The sluice sections contains passages for three 6 x 6 foot timber sluice gates separated by 2-foot thick reinforced concrete intermediate piers. The timber gates seal up against a shallow overflow wall with a top elevation at 589.1 MSL, permitting the flow of water over the sluice gates in case the gates are left in the closed position. The pier concrete visible is well aligned and the lift joints are smooth, showing so significant offsets. The concrete surface are new and undeteriorated. The bottom concrete slab of the sluice passages was underwater and could not be inspected in the dry. No downstream channel protection was visible beyond the limits of the apron.

The sluice gates are constructed of timber using corrosion resistant fasteners. The operators, manufactured by Rodney Hunt Inc., are of the rising stem type and provide for two operating speeds, achieved by a combination of 90 degree bevel gearing and spur gearing. The gates can be operated manually by a hand crank placed on either of the two input shafts or they can be operated electrically by a hand held power drill equipped with a special fitting to match the input shafts on the operating mechanism. Electrical power is supplied from an outlet in the gate access house located just to the left of the sluice gates. All three gates and their operating mechanism are in excellent condition.

(3) New Stop Plank Section. The stop plank section has been rebuilt in 1977 replacing a fixed crest concrete overflow weir. The concrete work is new and undeteriorated. This section shares a common foundation slab with the adjacent sluice gate section, which could not be inspected due to high tailwater conditions. The stop plank section

consists of 3 bays, each 4 ft.-8 in. wide. The horizontal planks are supported inside wall resesses and by intermediate steel stanchions. The individual timber stop planks are 2 1/2 in. x 7 1/2 in. standard size. They are fitted with eyebolts for handling, and can be conveniently removed and replaced from a concrete walkway above. The stop planks are locked in their grooves to prevent unauthorized removal. The entire stop plank section and components are in excellent physical condition.

(4) <u>Abutment Wingwalls</u>. The left abutment wingwall has been resurfaced with reinforced concrete overlaying an existing cut-stone masonry wall construction. An upstream cutoff has been added, running 6 ft. further into the abutment hillside. All surfaces are excellent.

The right abutment wingwall has also apparently been refaced or rebuilt although no mention of this work exists in the NH-WRB reconstruction drawings. All surfaces are excellent.

#### (5) Foundation of the Dam.

The dam is allegedly founded on a timber crib and is said to have a timber cutoff. No parts of this foundation system were visible for inspection during the field visit. The general geological setting is as follows:

A terrace, 20-25 feet above the river, occurs east of the left abutment. Terrace material in this deposit is a medium-grained silty, gravelly sand. Gravel sizes average one half inch. Similar material probably occurs in the right abutment terrace 10-12 ft. above the river. Coarse-grained silty gravelly sand is exposed in river bank a few tens of feet downstream of the dam. Gravels were up to 2 in. in size. The abutments and stream section of this dam are probably founded on these recent stream deposits. No seepage was observed in the banks downstream of the dam but some seepage under the dam is likely to occur in this type of foundation material, if not adequately cut off.

#### c. Appurtenances

A gate access house is located on the massive rebuilt masonry pier between the sluice gate and stop plank sections. It effectively blocks access to the sluice gate operating stands from the main access to the dam on the left abutment. The gate access house contains the electrical power supply source for the portable electric drill which is used to operate the sluice gates. Also located in the access house is a Telemark float gage used to measure the water level upstream of the dam. The gage has a transponder—which transmits coded lake level data over a telephone line to the NH-WRB headquarters in Concord.

At present, the gage is not considered to be accurate, due to its location. The dam (and the gage) is located on the river channel approximately 500 feet downstream of the lake outlet. Whenever there is flow in the river channel, there is a difference in elevation between the lake level and the upstream side of the dam. The owners are in the process of installing a length of galvanized pipe from the Telemark gage float well to the lake itself. In this way, the float will register the actual level of the lake rather than the level of the river at the dam.

There is a staff gage affixed to the abutment of a bridge crossing the channel of the Newfound River just at the outlet of the lake. This gage has its datum at Elevation 581.88 and indicates the correct level of Newfound Lake. The discharge at the dam is determined by observation of a tailwater staff gage affixed to the left channel bank approximately 150 ft.below the dam. Gage readings have been correlated to discharges up to 2,180 cfs. The sluice gates are operated until the desired tailwater depth is achieved consistent with the targeted discharge.

#### d. Reservoir

The reservoir rim is generally flat to moderately sloping for the first 5 to 6 feet above the full lake level and moderately sloping above that. The lake rim is naturally wooded, with local clearings where summer cottages or residences have been constructed. No signs of reservoir rim instability could be visually detected. The dam is located along the river channel, some 500 feet downstream of the lake outlet. The upstream channel is well defined and unobstructed. Riprap protection has been provided on the right river bank upstream of the abutment wingwall. This riprap is in good condition.

#### e. Downstream Channel

The downstream channel is well defined, unobstructed and at a moderately steep hydraulic slope. The stream banks are 6 to 8-foot high immediately downstream of the dam and have slopes of 1 on 2 horizontal. Riprap placed along the right channel side downstream of the dam is in good condition and the riprap protection on the downstream left bank is in acceptable condition. There is a power generating dam downstream of Newfound Lake Dam in current use.

#### 3.2 Evaluation

The overall physical condition of the dam is very good, due to its recent renovation. No conditions were uncovered during the visual phase that require further examination and review except for periodic inspection of the concrete apron downstream of the sluice gate and new stop plank sections.

#### SECTION 4

#### OPERATIONAL PROCEDURES

#### 4.1 Procedures

Newfound Lake Dam is operated under tight lake level surveillance and control by the N.H. Water Resources Board (NH-WRB). Lake levels are automatically read at the dam site and telephonically monitored in NH-WRB headquarters in Concord. The dam is visited twice a week by a dam operator for the WRB to adjust the sluice gate openings to meet targeted lake levels. Additional visits are made, if required by unusual circumstances. Lake release discharges are determined by WRB engineers based on targeted lake levels and lake inflows. A minimum discharge of 45 cfs is maintained in the Newfound River at all times. The lake levels are seasonally adjusted as described in Section 1.2.i. above. Required discharges are met by the dam operator by observation of a tailwater gage which has been calibrated against discharges up to 2,180 cfs. Changes in discharges at Newfound Lake Dam are communicated to the operators of a power dam owned by the International Packing Corporation in the river reach downstream of the dam.

#### 4.2 Maintenance of Dam

Maintenance of the dam is on an as-needed basis, based on the reports by the dam operators. Because of the newness of the reconstructed facility, no scheduled maintenance is being carried out.

#### 4.3 Maintenance of Operating Facilities

The sluice gate hoist mechanisms are maintained in connection with the periodic visits to the dam site on an as-needed basis.

#### 4.4 Description of any Warning System in Effect

The dam operators at the downstream power dam are notified by the NH-WRB dam operator when river discharges at Newfound Lake Dam are changed.

#### 4.5 Evaluation

Operational procedures are considered adequate in line with the degree of lake level control being exercised. A formal bi-annual inspection should be initiated utilizing the format of the Corps of Engineers check list. These inspection reports should be kept on file. Logs should be kept of the operation and maintenance of the sluice gates and stop planks. Records should be kept of water levels in the lake and in the stream during unusual storm events and pond dewaterings.

The downstream aprons should be dewatered at a convenient time and inspected at 10-year intervals.

Even though the dam is normally unattended, it would be desirable to establish some sort of communication channels to the downstream community of Bristol, to alert it to the possibility of impending high stream stages in case of dam accident or failure.

#### SECTION 5

#### HYDRAULIC/HYDROLOGIC

#### 5.1 Evaluation of Features

#### a. Design Data

The evaluation of the hydraulic and hydrologic features of the Newfound Lake Dam was based on criteria set forth in the Corps' Guidelines for Phase I inspections, and additional guidance provided by the New England Division, Corps of Engineers. The Probable Maximum Flood (PMF) was estimated from guide curves for probable maximum flood for New England region, based on past Corps' studies. The PMF peak versus drainage area curves are presented in the section of hydrologic computations.

The PMF curve applicable for rolling areas was adopted for the estimation of PMF peak of the Newfound Lake Dam watershed. The PMF versus drainage area relationship can be expressed mathematically as follows:

$$Q = 2323 - 676.99 \log_{10}A$$

$$Qp = Q \times A$$

where

Q = Unit peak discharge in cfs/square miles

Qp = Peak PMF discharge, in cfs, for the watershed

A = Watershed area, in square miles, upstream of the dam axis

The computed peak discharge of PMF for a drainage area of 95 square miles using the above equation is 93,500 cfs. A triangular shaped flood hydrograph was assumed for the inflow design hydrograph.

The PMF inflow hydrograph was routed through the reservoir by the modified Puls Method, utilizing computer program HEC-1. The peak outflow discharges for the PMF is 16,161 cfs, and results in overtopping of the dam.

The reservoir stage-capacity curve was constructed using comparisons of both dam inventory data and planimetered areas, measured from 15 minute quadrangle topography maps. Reservoir storage capacity included surcharge levels exceeding the top of the dam and assumed that the dam remains intact during routing. In the routing computations, the assumption was made that the stop planks are in place up to the normal summertime lake level Elevation 588.4 (lake gage 6.5) and that the three 6 x 6 foot sluice gate openings are fully open.

Since the spillway of the dam is incapable of passing the PMF without overtopping the dam, an assessment of downstream hazards due to a flood wave that would result with dam failure was also estimated. The magnitude of the flood wave was estimated using generally accepted "rule of thumb" computational procedures established by the New England Division of the Corps of Engineers, in combination with sound hydrologic engineering judgement.

Computations relating to the flood routing of the dam break hydrograph for downstream areas are given in the section on hydrologic computations. The result of this computation shows that in the event of a hypothetical dam failure at the time the lake level is at the top of dam, a lake discharge of about 9,250 cfs would be released. Flood stages in the downstream channel reaches are given in the following table:

#### TABLE 1

Distance Downstream of Dam Axis (Miles)	Est.	Flood Stage (Feet)
0.04		9.0
1.0		8.2
2.0 (Bristol)		9.6

The flood stages would affect the structural stability of those buildings in the downstream reach, whose foundations are below the hypothetical inundation level, and could cause large scale property damage and possible loss of lives.

#### b. Experience Data

A summary record of the maximum annual reservoir stage is available for this site, which shows that the dam has not been overtopped since 1937, although it did come within one inch and a half of doing so during 1973. The modifications made to the sluice gate passages and the addition of the new stop plank section should reduce the overtopping hazard somewhat.

#### c. Visual Observations

The river channel upstream of the dam is shallow and rapidly flowing. The lake appears to be very much deeper. A considerable amount of the lake storage is inactive. The maximum drawdown possible is not determinable without a detailed survey of the stream channel at the lake outlet.

#### d. Overtopping Potential

As indicated in Section 5.1.a., the PMF, when routed through Newfound Lake Reservoir, results in overtopping the dam. The spillway and reservoir surcharge capacities are too small to accommodate the peak flow. The PMF

would overtop the dam by 12.7 feet. The spillway is only capable of passing a flood equal to approximately 19 percent of the PMF without overtopping the dam. Since PMF is the Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Inspection of Dams by the Corps, the spillway capacity of the Newfound Lake Dam is considered seriously inadequate. The basic data employed in the evaluation of the hydraulics of the channel reaches upstream and downstream of the dam for this Phase I Study are very preliminary in nature and contain uncertainties as to the relationships between concurrent water levels at the main part of the lake and at the dam. The discharge over the dam during storm events of PMF magnitude may also be affected by the general submergence of the dam although the preliminary evaluation of this effect indicates that it is not likely to be significant. It is recommended that further studies be made by the owner to further refine the hydraulic characteristics of the channel reaches upstream and downstream of the dam based on more definitive data to be acquired.

#### SECTION 6

#### STRUCTURAL STABILITY

#### 6.1 Evaluation of Structural Stability

#### a. Visual Observations

There are no signs of structural instability apparent on visual examination. No leakage or seepage was observed at the abutments or at the toe of the dam where not obscured by water overflowing the various sections of the dam. The dam appeared to be in good alignment and no settlement could be detected. There were no noticeable cracks or excessive deflections to indicate overstressed conditions. On the basis of the visual examination and the dam's 138-year service history, structural stability under present conditions is not of great concern because of the dam's low height and relatively substantial width as related to its height.

#### b. <u>Design and Construction Data</u>

Insufficient documentation has been recovered to assess the structural stability of the dam. No cross sections of the timber dam are available and the depth to the foundation crib is not defined. No data is available on the dimensions and properties of the foundation timber crib on which the dam is apparently founded. There is no pertinent construction data on which an evaluation of structural stability can be founded.

#### c. Operating Records

High water records documented since 1937 indicate that the dam has apparently not suffered damage at lake levels rising to within one and one half inches of overtopping the structure. Not enough time has elapsed since the 1977 dam modifications to assess the stability of the modified structure under severe hydraulic loadings.

#### d. Post Construction Changes

The modifications completed in 1977 are believed to enhance the stability of the dam. The new base slab underlying the sluice gate and new stop plank sections are tied into the massive piers and a long left abutment wingwall. The weight of these structural components are mobilized for stability and the new slab spreads any imbalances to the timber crib foundation below. The reinforced concrete overlays covering the masonry piers and left abutment wingwall are useful in stabilizing the structural integrity of these components.

#### e. Seismic Stability

The dam is located in Seismic Zone 2 and, in accordance with the Recommended Phase I Guidelines does not warrant seismic analyses.

## SECTION 7

# ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

## 7.1 Dam Assessment

## a. Condition

The overall physical condition of Newfound Lake Dam is good as a result of the modifications completed in 1977. The dam has a seriously inadequate spillway capacity, capable of passing only 19 percent of the Spillway Design Flood (SDF) without overtopping of the dam. Overtopping of the dam carries with it the risk of undermining parts of the dam, possibly leading to progressive failure. The spillway discharge capacity has been estimated by current Corps of Engineers screening criteria, and the owner should determine the spillway capacity by more sophisticated and accurate methods and procedures.

# b. Adequacy of Information

Even though there is a lack of plans, sections and details of the timber dam portion and a similar lack of information concerning the foundation timber crib, an adequate assessment of the dam consistent within the scope of a Phase I investigation is possible based upon the visual inspection and available information.

### c. Urgency

The urgency of performing the recommendations and remedial measures are detailed below.

# d. Need for Additional Investigations

There is no need for further investigations in this phase of the program. Recommended investigations to be carried out by the owner are listed below.

# 7.2 Recommendations

It is recommended that the owner, within 24 months after the receipt of this Phase I Report, assemble the following:

## a. Data Acquisition

- (1) An updated as-built set of drawings of the dam showing all pertinent details and correcting information gaps on the presently available drawings.
- (2) The details of the timber crib dam should be added to the set from an as-built survey of the dam to the extent determinable.
- (3) Properties and details of the underlying timber crib foundation uncovered during the modifications completed in 1977 should be added to the record set.
- (4) A topographic survey of the channel and overbank area upstream of the dam should be undertaken and channel cross section taken at reasonable intervals to determine the maximum lake level drawdown possible.
- (5) The character of the channel bottom should be investigated in detail to determine its erodibility in the event of a hypothetical dam failure.

# b. <u>Investigations</u>

Determine and document the spillway capacity of the dam using more sophisticated and accurate methods than were used in the Phase I screening methodology employed in this report, including the routing of the inflow through the lake. A tailwater rating curve should be computed for very large discharge volumes, extending the range of the present curve.

Based on the results of the spillway capacity analyses, the owner should formulate plans for augmenting the spillway capacity if shown necessary.

## 7.3 Remedial Measures

# a. Alternatives

The alternatives available for augmenting the spillway capacity of the dam are:

- (1) Raising the non-overflow parts of the dam to permit greater heads and discharges over and through the existing facilities.
- (2) Provision of additional spillway capacity at the left abutment by a fixed weir and culvert structure under the present access road.
- (3) Addition of spillway capacity along the right abutment either in the open or in a culvert to minimize the effect on the existing structure on the abutment.
- (4) Seasonal regulation of the lake levels to provide additional storage capacity in anticipation of large runoff events.
  - (5) A combination of the above methods.

# b. 0&M Maintenance and Procedures

The owner should initiate the following programs:

- (1) An bi-annual inspection of the dam utilizing a visual check list similar to that used in this inspection report.
- (2) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance. Dewater the downstream apron area at 10-year intervals, and inspect for scour and channel degradation and undercutting.
- (3) Assemble and keep on hand complete documentation of the dam design, as-built drawings, and any other data pertaining to the dam safety.
- (4) The owner should establish a formal system with local officials for warning downstream residents in case of emergency. Round the clock surveillance should be provided by the owner during periods of unusually heavy precipitation.

# APPENDIX A

CHECK LISTS: - VISUAL OBSERVATIONS

- ENGINEERING, CONSTRUCTION MAINTENANCE DATA
- HYDRAULIC AND HYDROLOGIC DATA ENGINEERING DATA

# CHECK LIST VISUAL INSPECTION

PHASE 1

Name Dam NEWFOUND LAKE DAM	County _	Grafton .	State New Hampshire Coordinators	
Date(s) Inspection June 5, 1978	Weather	Light Rain	_ Temperature65°F	
Pool Elevation at Time of Inspection	588.9	M.S.L.	Tailwater at Time of Inspection 581.8 M.S.L	. •
Inspection Personnel:				
Seymour Roth	•	Lynn Brown		
David Kerkes	·	Eilliam Flynn		
Yin Au-Yeung				
Recorder: Seymour M. Roth		•		

Representing the N.H. Water Resources Board, Owner of the  $\mathsf{Dam}$ :

Mr. Lyall Milligan, Dam Operator

# CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE	None observed at either abutment.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	The junction of the dam to the abutments is in the form of concrete wingwalls perpendicular to the dam axis. On the left abutment, a cutoff wall 8-foot long ties into higher ground. The access road level on this side is approximately 3 feet above the dam top. On the right abutment, the ground is lower and could be used as an auxiliary spillway.	
DRAINS	None installed.	
WATER PASSAGES	Three 6-foot wide open sluice gate passages are installed in the center of the dam controlled by wooden sluice gates and hoists. Three stop plank passages each 4 ft-8 in. wide are installed adjacent to the left abutment. A concrete walkway has been provided over the sluice gate and stop plank sections of the dam for access and operation.	
FOUNDATIONS	Timber crib foundation and wood cutoff according to plans could not be visually inspected or verified due to head and tailwater levels prevailing.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
SURFACE CRACKS CONCRETE SURFACES	All concrete surfaces are in good to excellent condition, with little or no surface deterioration due to weathering or water caused erosion.	
STRUCTURAL CRACKING	None observed.	
VERTICAL & HORIZONTAL ALIGNMENT	All alignments seemed good on visual inspection.	
MONOLITH JOINTS	None observed.	

# TIMBER DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
GENERAL CONDITION	The timber dam on the right abutment seemed in good service-able condition. Main brace timbers are in sound condition and have top surfaces protected by sheet metal against excessive wetting. Timber dam has 6 8-foot wide bays each accommodating 2 stop plank passes.	No action required.
FOUNDATION	The foundation is apparently a timber crib. The floor of the timber dam section is timber and is continuously wetted. Timber condition appeared good. Cutoff and crib timber not visible.	No action required.
STOP PLANKS	All stop planks were in place and appeared to be in sound condition. Some stop planks are not tightly butted against each other permitting leakage between sections.	No action required.
DISCHARGE CHANNEL & TOE PROTECTION	Irregularly placed stones at toe of timber dam section.	
BRIDGE	A wooden walkway over the timber dam section connects the right abutment to the adjacent sluice gate section.	

		EMBANKMENT	
VISUAL EXAMINATION OF	b mangan gen ginag i ginaga kan nginggang ngingan gen genabah kata gina akab na pina akab na pina akab na pina Kantangan akab na pinagan akab na pinagan na na kantangan akab na pinagan na pinagan na pinagan kantangan kant	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANK- MENT AND ABUTMENT, SPILLWAY AND DAM	Not applicable		
ANY NOTICEABLE SEEPAGE	Not applicable		
STAFF GAGE AND RECORDER	Not applicable		
DRAINS	Not applicable		

# OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	All concrete surfaces are in excellent to good condition, showing little or no surface deterioration and no significant cracking.	
INTAKE STRUCTURE	Not applicable.	
OUTLET STRUCTURE	See comments under "Water Passages - Concrete Masonry Dam".	
OUTLET CHANNEL	The outlet channel downstream of the stop plank and sluice gate parts of the dam are protected by a concrete slab extending about 12 feet downstream of the end of the sluice gate piers; condition of the slab not determinable due to tailwater.	Inspect downstream apron slab at 10-year intervals.
EMERGENCY GATE	None.	

# UNGATED SPILLWAY

VISUAL EXAMINATION OF		OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	Not applicable		
APPROACH CHANNEL	Not applicable		·
	-		
DISCHARGE CHANNEL	Not applicable		
BRIDGE AND PIERS	Not applicable		

VISUAL EVANINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATION
VISUAL EXAMINATION OF CONCRETE SILL	Not applicable	REPARKS AND RECOMMENDATION
APPROACH CHANNEL	Not applicable	
DISCHARGE CHANNEL	Not applicable	
BRIDGE AND PIERS	Not applicable	
•		

	INSTRUMENTATION	
VISUAL EXAMINATION OF	OBSERVATIONS OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/ SURVEYS		
,		
OBSERVATION WELLS		
WEIRS		
PIEZOMETERS		
OTHERS	The dam has a lake gage mounted on the right abutment of the bridge over the head of the outlet channel. Gage zero is at Elevation 581.88 MSL and full lake is 7.23 gage. A Telemark recorder automatically records the lake level at the dam and transmits data over a telephone line to N.H. Water Resources Board offices at Concord. A tailwater staff gage in the downstream channel is used to determine discharges over and through the dam and regulate the discharge at the dam.	

·		RESERVOIR	
VISUAL EXAMINAT	ION OF	OBSERVATIONS	REMARKS AND RECOMMENTATION
SLOPES	·	The reservoir rim slopes are very mild to about levation 595, or 5 to 6 feet above normal lake level and moderately sloping after that level.	
	.•		
·			
SEDIMENTATION		No sedimentation is noticeable in the channel of the Newfound River between the main body of the lake and the	
•		dam.	
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# DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is well defined and unobstructed.	
SLOPES	The side slopes of the downstream channel are about 1 on 2 horizontal and the channel is about 6 to 8-foot deep.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	There is one residence on the right abutment immediately downstream of the channel. A power dam islocated approx. 3/4 mile downstream of the dam axis. The population center of Bristol is approximately 2 1/4 miles downstream, with parts of town as close as 1.5miles below the dam. The population of Bristol is estimated at 1,000.	

# CHECK LIST ENGINEERING DATA DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Partial plan of 1977 reconstruction available. The timber dam section does not have a usable plan.
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Not available in records of N.H. Water Resources Board.
TYPICAL SECTIONS OF DAM	Available for 1977 reconstruction.
HYDROLOGIC/HYDRAULIC DATA	Rating curve for stop plank section available. Rating curve for 6 x 6 sluices not uncovered. Lake level record available.
OUTLETS - PLAN	)
- DETAILS	Available for 1977 reconstruction
- CONSTRAINTS	None discovered
- DISCHARGE RATINGS	Available for stop plank section
RAINFALL / RESERVOIR RECORDS	Reservoir records concerning maximum annual lake level available from 1937 onward with several gaps in the record.

# CHECK LIST ENGINEERING DATA DESIGN, CONSTRUCTION, OPERATION (continued)

ITEM	REMARKS
DESIGN REPORTS	None uncovered
GEOLOGY REPORTS	None uncovered
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	<pre>Structural computation for sluice gate design, minor parts of the stop plank section and cuoff wall are available. } No stability or seepage studies uncovered.</pre>
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None uncovered
POST-CONSTRUCTION SURVEYS OF DAM	None uncovered
BORROW SOURCES	Not applicable
SPILLWAY PLAN - SECTIONS - DETAILS	) Drawings details of the 1977 reconstruction available. ) No drawings of the timber dam section or foundation are available. )

# CHECK LIST ENGINEERING DATA DESIGN, CONSTRUCTION, OPERATION (continued)

ITEM	REMARKS		
OPERATING EQUIPMENT PLANS AND DETAILS	Details of the sluice gates and stop plank section are available.		
MONITORING SYSTEMS	Automatic lake level recorder and coded telephonic signal transmission to N.H. Water Resources Board headquarters, in Concord, N.H.  Dam rebuilt in 1977. New sluice gates section and stop plank section added.		
MODIFICATIONS			
HIGH POOL RECORDS	Available from 1937 onwards, but with significant gaps in the records.		
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None uncovered		
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None uncovered		
MAINTENANCE OPERATION RECORDS	None uncovered		

# CHECK LIST HYDROLOGIC AND HYDRAULIC DATA ENGINEERING DATA

Name of Dam: NEWFOUND LAKE DAM
Drainage Area Characteristics: 95 square miles
Elevation Top Normal Pool (Storage Capacity): 588.4 (24,557 AF)
Elevation Top Flood Control Pool (Storage Capacity): NA
Elevation Maximum Design Pool: 589.1
Elevation Top Dam: 592.1
SPILLWAY CREST:
a. Elevation <u>588.4</u>
b. Type Stop log sections
c. Width 2 1/2 inches (stop planks)
d. Length 56 ft6 in. in two sections
e. Location Spillover 43 ft6 in. on right abutment, 13 ft0 in. on
f. No. and Type of Gates None left abutment
OUTLET WORK:
a. Type Three 6 x 6 ft. sluice gates, timber construction
b. Location Center of dam
c. Entrance Inverts 581.1
d. Exit Inverts581.4
e. Emergency Draindown Facilities Sluices are used for this purpose
HYDROMETEOROLOGICAL GAGES:
a. Type Staff gage channel
b. Location At exit of Newfound Lake
c. Records Forwarded to U.S.G.S.
MAXIMUM NON-DAMAGING DISCHARGE 1,700 cfs (estimated)

APPENDIX B

**PHOTOGRAPHS** 

All Photographs taken on June 5, 1978



Photo 1 - Detailed view of the timber dam at the right abutment from downstream.

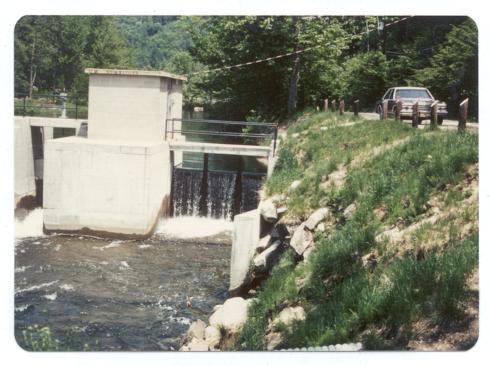


Photo 2 - View of the 6 ft. x 6 ft. sluice gate passage, gate access house and the new stop plank section on left abutment of the dam looking from downstream.



Photo 3 - View of the sluice gate section, the gate access house and the new stop plank section from upstream.



Photo 4 - View of the timber dam section and the right abutment from the upstream side.



Photo 5 - View of the approach channel of Newfound River from the dam. The dam is located approximately 500 ft. downstream of the natural outlet of Newfound Lake. Note the sluice gate hoist stand in the foreground.



Photo 6 - View of the downstream channel of Newfound River taken from the dam.

APPENDIX C

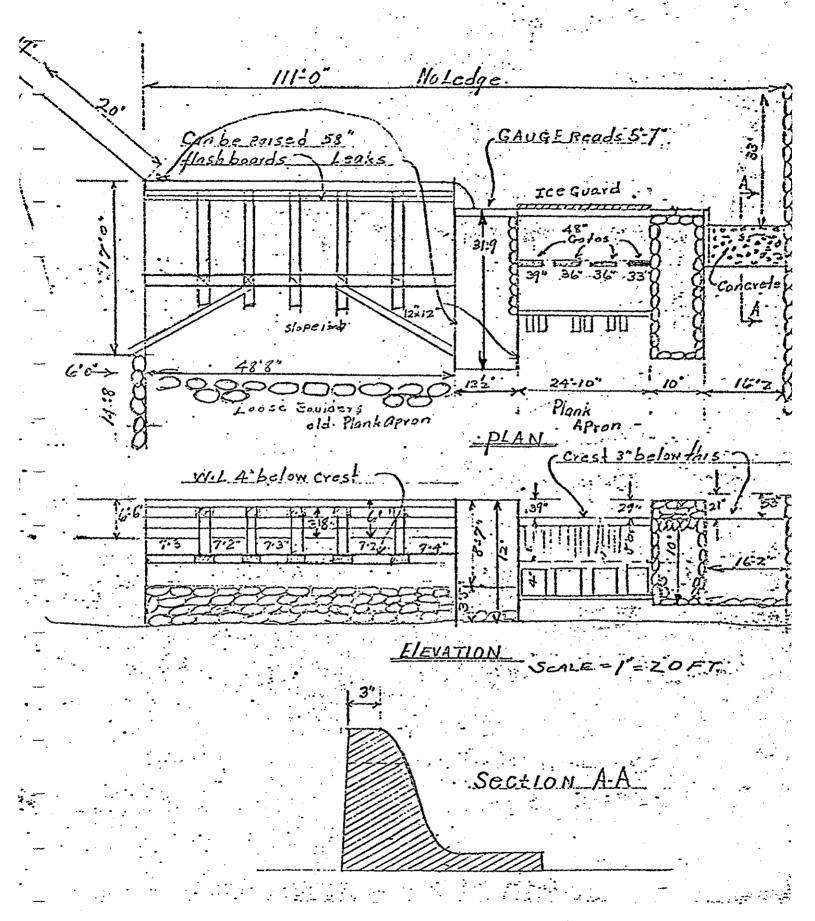
PLATES

PLANS AND DETAILS OF DAM

GEOLOGICAL MAP

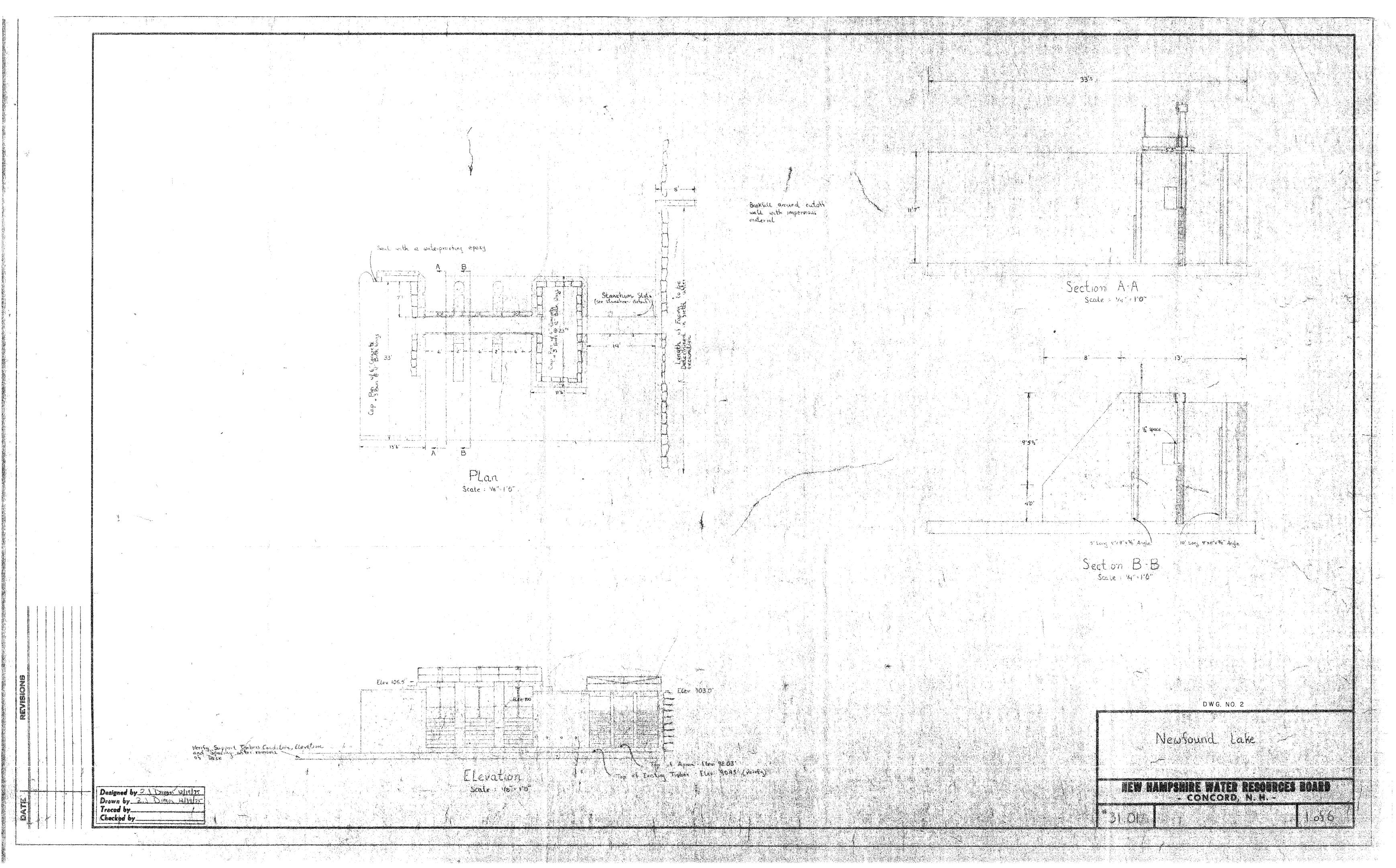
Drawings 1,2,3,4 & 5

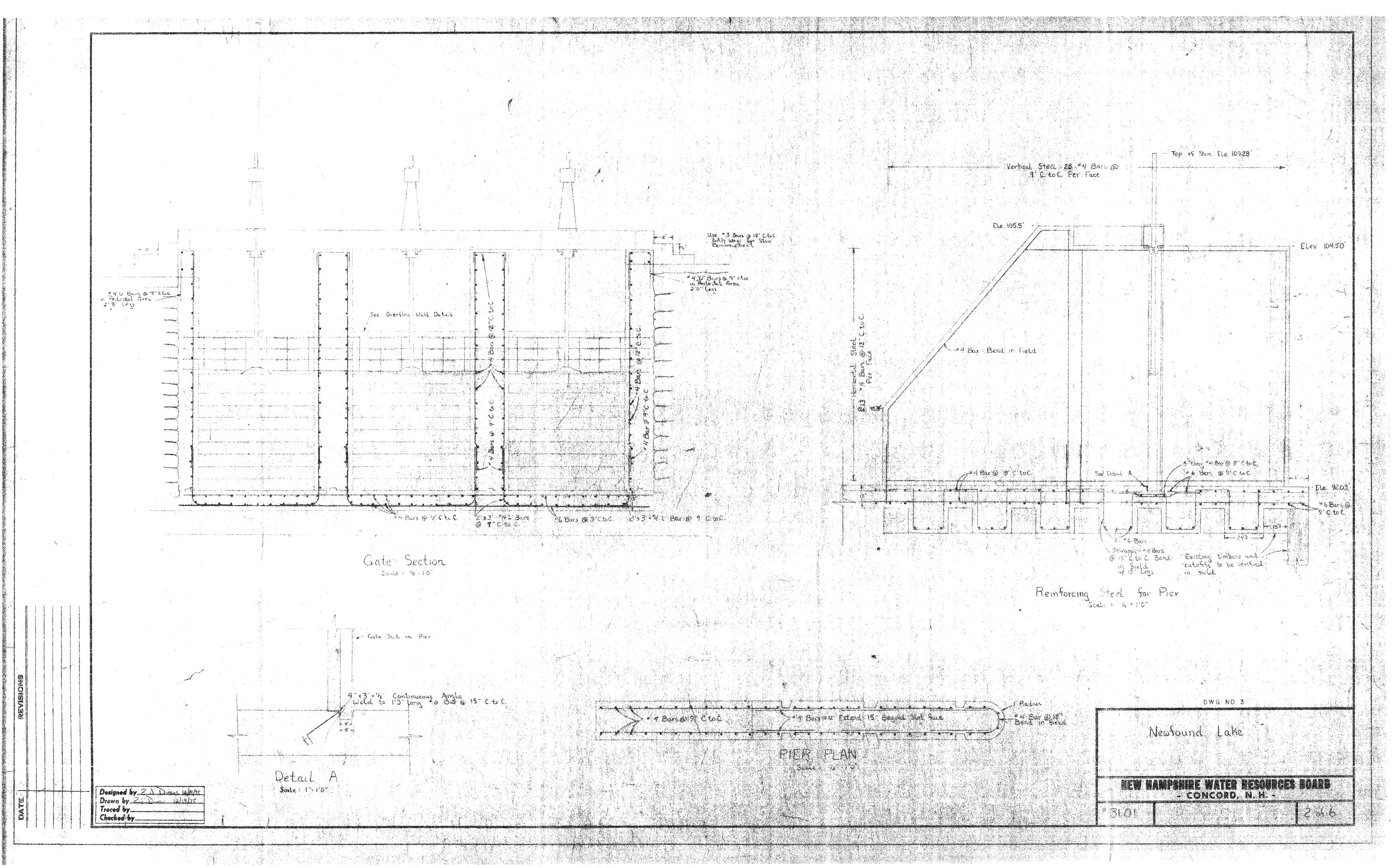
Drawing 6

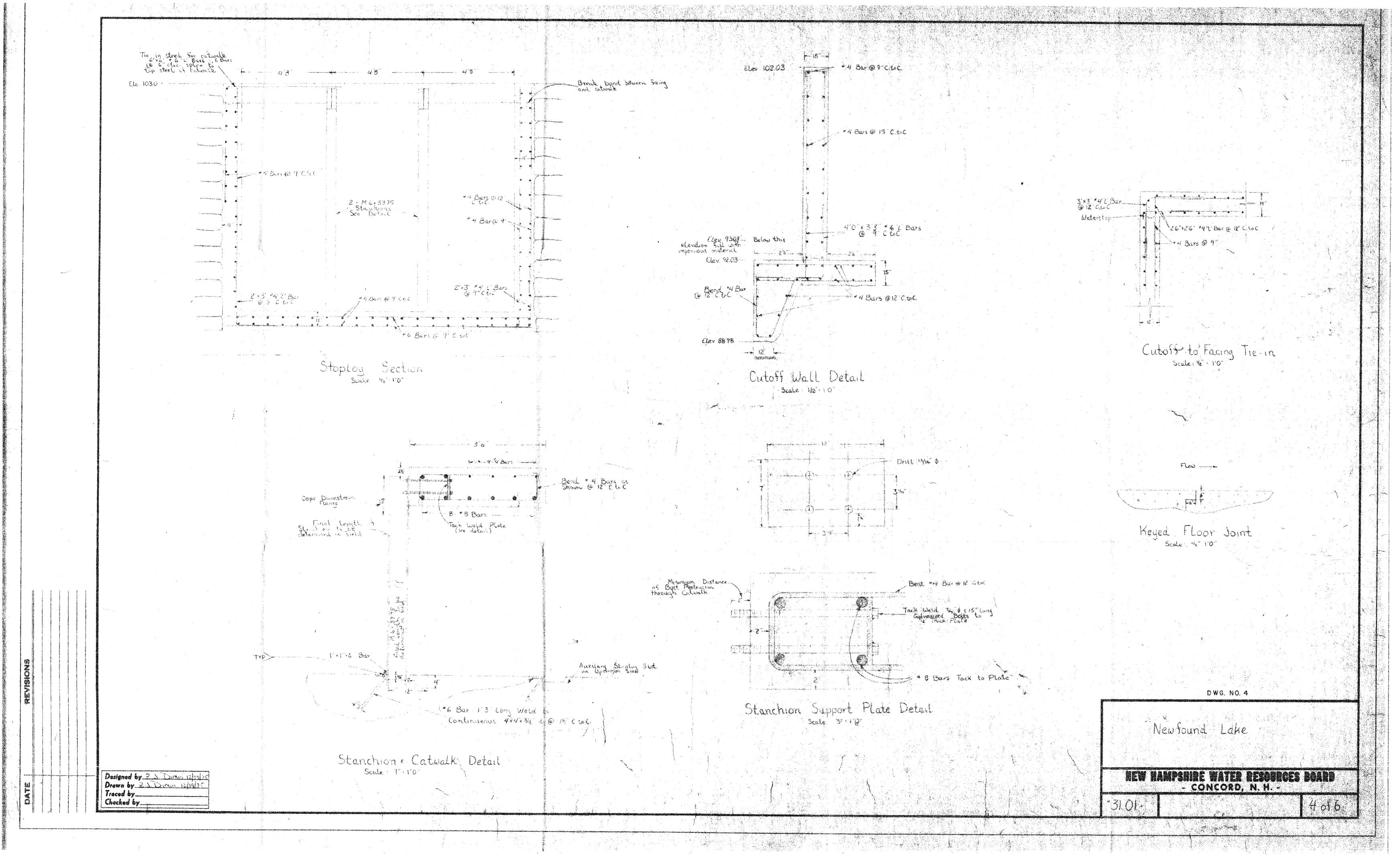


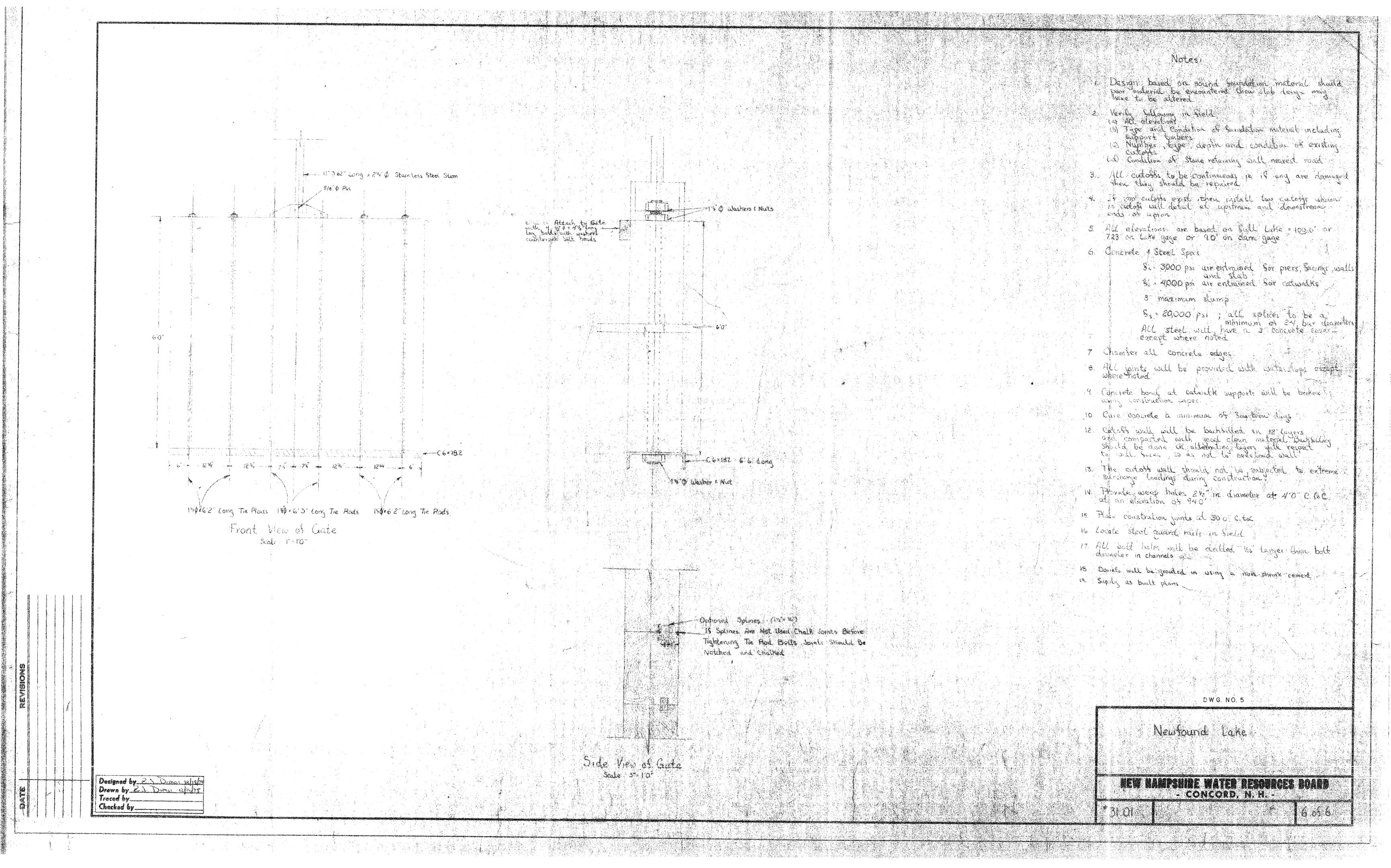
HARRIS-ECI ASSOCIATES

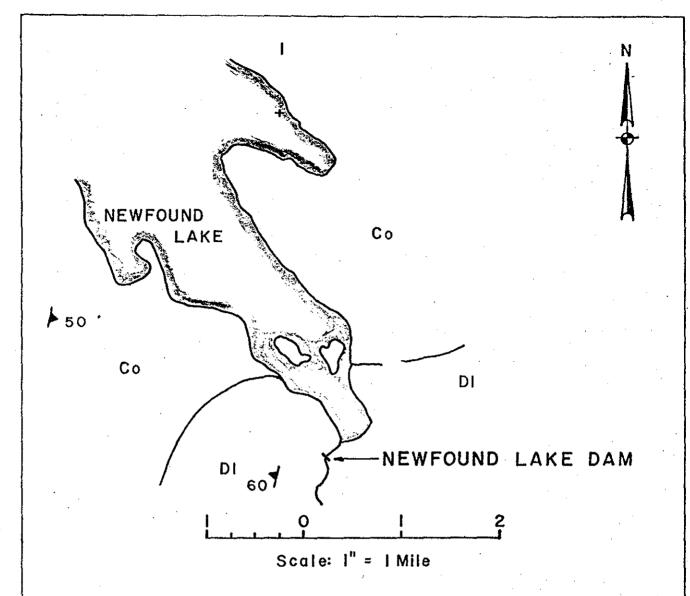
NEWFOUND LAKE - LAKE OUTLET - DWG. I











# LEGEND:

Co Granite, Fine - to Coarse - Grained

DI Quartz - Garnet - Mica Schist

60 **y** Strike and Dip of Foliation

Contact

# NOTES: I. Ground Moraine Mantles Bedrock Near the Dam

2. Silty Gravelly Sand Occurs Along Stream Banks as Terrace Deposits from Glacial Outwash or Recent Stream Action

GEOLOGIC MAP NEWFOUND DAM

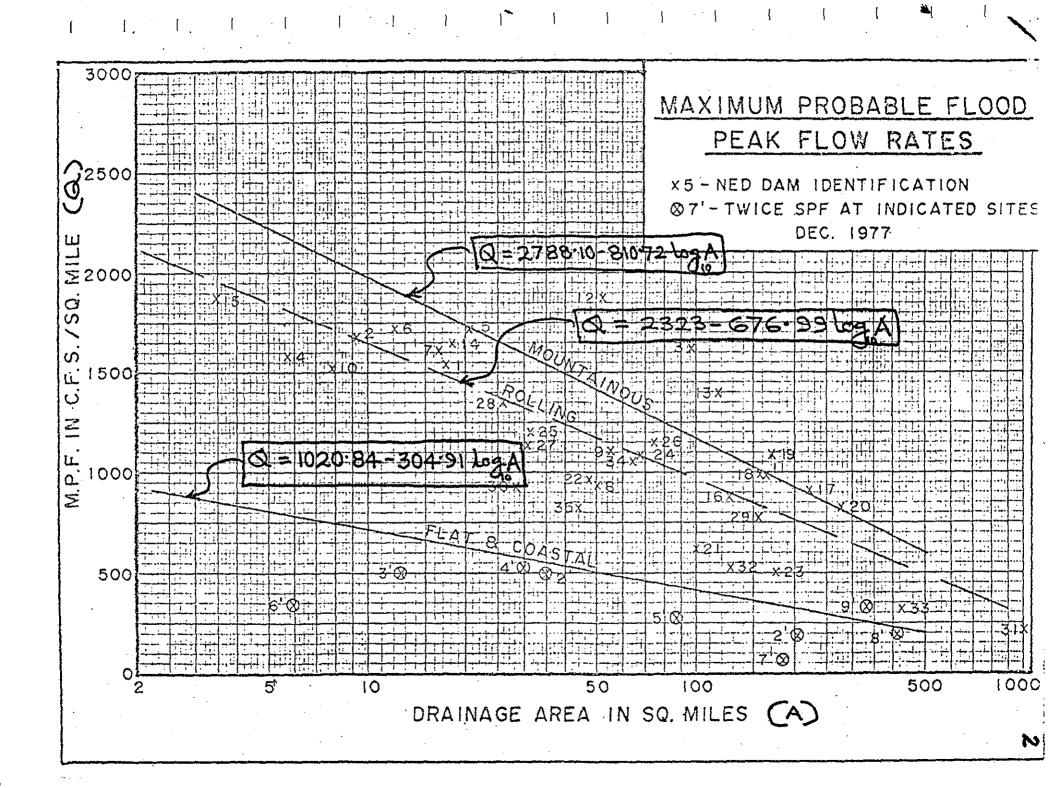
DWG. NO. 6

APPENDIX D

HYDROLOGIC COMPUTATIONS



NEWFOUND LAKE DAM DRAINAGE BASIN



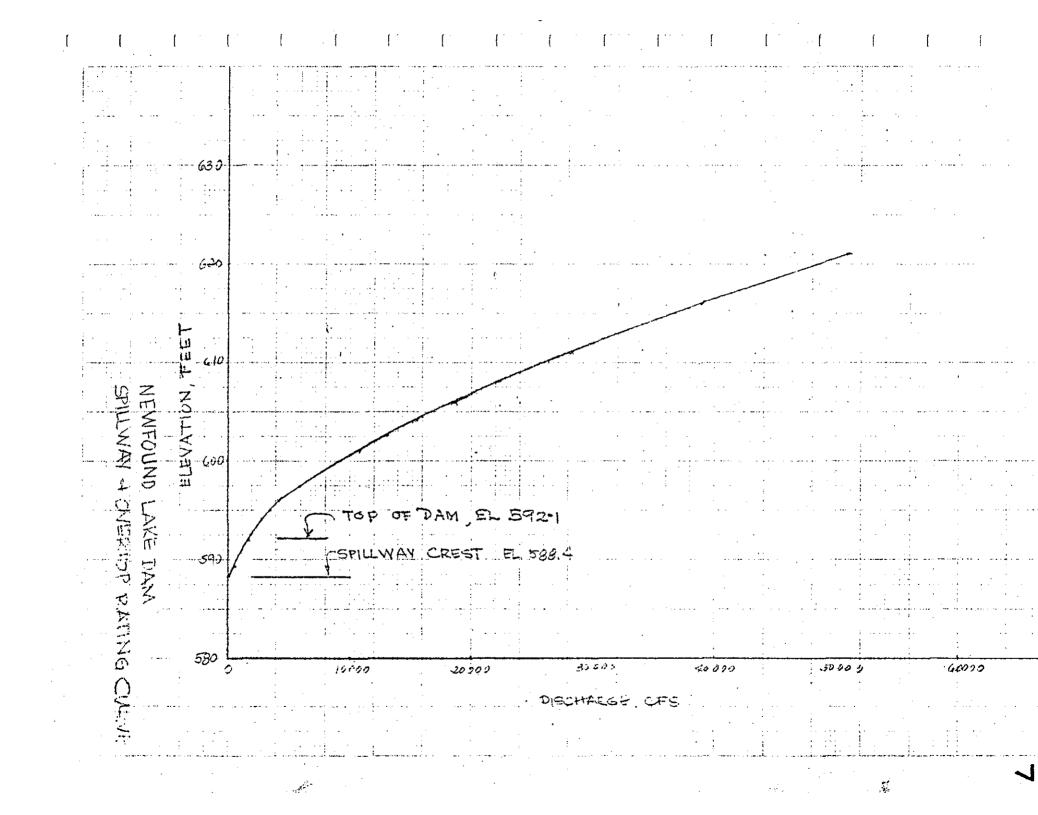
ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION	SHEET NO. / OF
NEW FOUND LAKE DAM	_ JOB NO. <u>/2//- ОО/- /</u>
- PRIF HYDROGRAPH	BY 14 8 DATE 7-3/-
	Um
- MAXIMUM PROBABLE FLOOD PEAK FLOW	RATE
ACCORDING TO NED GENERAL CURVE	
ASSUME FOLLING ARFA	
A = 95 50, Mi.	
- Q = 2323 - 676-99 LOGIOA	
Q= 984 CFS/5Q, Mi	
Op = AXQ = 95 X 984 = 93,50	CFS
- SINCE PAF RUNOFF IN NEW ENGLAND FOUR	ALS ABOUT 19 INCHES
ACCORDING TO NED GUIDELINES	
THE TRIANGULAR SHAFED HYDROGRAPH	Will BE
APPROXIMATED BY THE FOLLOWING SHA	PE
- VOLUME = 19" XA = 12 To X AP	
: To = 2[(19/12) x 95 x (5280)2] / [3600 x	× 93500] ≈ 25 111
100000	93,500 CFS
5 10 15	20 25
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TEV ON SALL	WAY ST, ST	Hz H3	H¢ Ar	H. H.	# •	A		SCHTMENEONED
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631.1 43, 631.1 53,	7 12,71	32,7 32.7 42,7 42,7 52,7 52,7	40.8 39	39 38 49 48	24.5 36.5 46.5	77615 107935		DAM
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Fi	EET	CREST FI												<u>                                     </u>
5	88.4	0	0:								0			1
5	88.7	0.3	0.3	0.3	0,3						313	1,		-
5	89.4	1.0	1.0:	.0	1,0						643			-
5	90.3	1,9	1.9	.9	1,9						935			+
5	907	2.3	J2,3·	2.5	2,3	0.4					1086			1
5	91.6	3.2	-3.22	3.2	3,2	1,3					1573			1
5	92.1	3,7	3,7	8,7	3.7	1.8					1211			-
5	33.1	4.7	-4.7	4,7	4.7	2.8		1			2185			
5	94.1	5.7	5,7	5,7	5.7	3.8	2	3			2827			
ۍ	94.6	6,2	6.2	6,2	6.3	4.3	25	2.5	1,5		3.188			
5	95.1	6.7	-67:	4,7	6,7	4.8	3,0	3.0	2.0	7	3596			-
5	96.1	7.7	7,7	7,7	7,7	5.8	4,0	4.0	3,0	1,5	4228			
61	01.1	12.7	12.7	12.7	12.7	10.8	9.0	9.0	8.0	6.5	10696			1.

NEW HAMPSHIRE NEWFOUND SAF CTY HNSPECTION JOB NO. 12(1-60)



\_FREDERIC R. HARRIS, INC.

CONSULTING ENGINEERS

SUBJECT NEW FAM SEE DAM INSPECTION SHEET NO. OF NEW FOUND LAKE DAM JOB NO. 10-937-0

COMPUTED BY ROTE CHECKED BY DATE AUG 1970

TAILWATER RATING CURIE!

TOOM BU NH-WRB

GAGE READING DISCHARGE ESTIMATED ELE \* ("By Harm's-ECI)

FT CFS

4.3 45 581.4 5.0 165 582.1 6.0 440 583. 7.0 820 584 ! 1280 80 585.1 1730 586.1 9,0 2130 586.8

\* Elevation are estimated so , and are affected by the uncontainty of the correlation of Newfound Lake levels in the main part of the lake and at the upsiness face of the dam.

_1	VEW HAMPSH	<u> </u>	1 1 1 1 2	CATE !!	MOFFICIUM	SHE	ET NO.	+- OF
	MEWFO				· · · · · ·			
	RESERVATE	W.	-11. P\ <	المراجد في وراجه	• •		PART	9-14-7

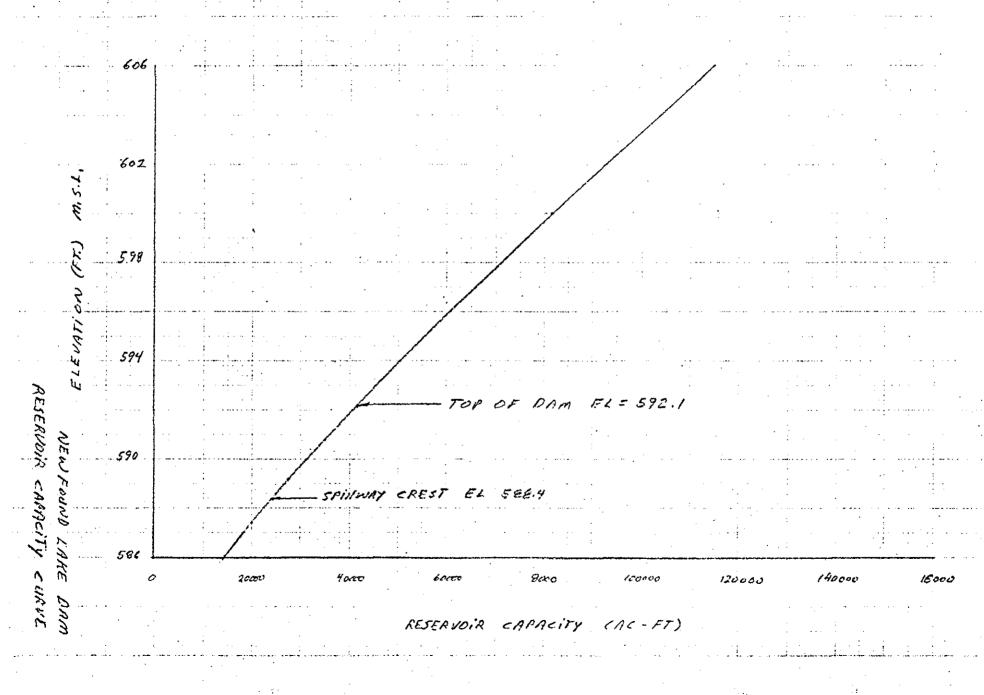
# NEWFOUND LAKE DAM RESERVER PRESS. CAVECITY

Reservoir Storage = 27,715 AF al EL 580.12

Top of dam al EL 592.1

Recreation pool al EL 583.4.

ELEVATION) FEET	RESERWIR ARE A ACRES	RESERVOIR CAPACITY ACRE-FT	REMARKS
586	422 4	14256	
588.4	4360	24557	RECREATION POOL
589,12	4410	277/5	
592.1	4670	41244	TOP OF DAM
600,0	5568	81684	
610	6960	144324	



ENGINEERING CONSULTANTS, INC.

	RE DAM SAFE DUND LAKE			
	AM FAILURE		JOB NO. <u>/2</u> /	•
	THI FAILURE	<u> </u>	BYBY	_DATE_ <u>8-3-78</u>
		_		
	NEWFOUND	D LAKE DAM	<u>n</u>	
	FFFECT OF	DAM FAILURE		
		<u> </u>	<b></b> -	
		•		
<u> 57FP1;</u>	DETER MINE	PEAK FAILUI	RE PP,	
	00 = 8 W	16 VZg 10 31	/2	
	•			
	Op, = FAILU	RE OUTFLOW	in crs.	
	No - 40%	OF DAM LE MID HEIGHT A	NGTH ACROSS K	RIVER
•		MID THE IGHT A		
	Yo = TOTAL	HEIGHT FRO	om RIVER BED	To
_	TOP	OF DAM		
	1/		- /2	
	Yo = 592	(ASSUMED)	= 12 Ft.	- 40 - 10 - 10 - 10 - 10 - 10 - 10 - 10
van de versie v	ing the second of the second o	RIVER		
and the second s	OAM			
	DAM LENGTH	' AT MID HEIG	IT = 102 FT	
			(FROM SKETCH	(ES)
and the second s	: W = 0,	40× 102,0 =	40.8 FT (2)	
			i i	
			3/2	
	Pp, = = 27 (40	1,8)164,4 (1	2.0)	
and the second s	Q = -	4000 CF5		
	7//		——————————————————————————————————————	
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				•
				· · · · · · · · · · · · · · · · · · ·

ECI-4	ENGINEERING	CONSUI	STNAT	. INC.

	NEWFOU	ND LAI	YE DAM		JOB NO. /2//-	001-1
			RE STUDY		BY KLB	ATE 8-3-7
To the second se						2 - 1
· · · · ·	STEP 2:	DEVELOI	O STAGE DI	SCHARGE	CURVES FO	R
					AT THE END	
			,	•	UNIFORM FLOW	. د ر <sup>د</sup>
			ININGS M=			
				•	VES FOR THE	E
				E CHANNE		
.*		ARE ON	PACES	3 THROUG	H <u>5</u>	
<i>ک</i>	TEP3:	DETERM	DINE STAG	E CORRES	PONDING T	ر م ده ه
		AT EA	CH SECT	TON ASSU	MING THE	· ·
		STAGE	DIS CHARGA	E CURVE	is VALID P	OR
		UNSTE.	ADY FLOW	CASE.		
		PEAK	DiscHARG	E = 00 =	4000 CFS	
1	*** ***					
1	DISTANCE DAM; (M		0,38 (2000FT)			
**************************************	STAGE,	(FFET)	9-,0	8.2	9.6	
		† :				The second secon
	and the second of the second					

## ENGINEERING CONSULTANTS, INC.

New	Hampshi	re Dam I Lake I	Solety -	Inspection	2SH	IEET NO. Z	OF
	Newfound	I Lake 1	02m		Jo	в NO. <u>/2//</u>	the state of the s
Dom	Failuce 1	<u>Hydrograph</u>					DATE 6/29/78
The second secon		Stage U	Ares A Sp. Al.	Wested Perimeter U.P.	Hydrovlië Realiùs R A!	AR21/3	Q=1.47 AR 435'L
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<u> </u>		0	0	, 0	0	0;	0
		1	160	80	2	254	350
		8	640	160	4	1613	2250
	e Eg	12	1440	240	6	4755	6630
		115	2480	3/0	8	9921	13820
		20	3700	370	10	17/15	23930
k		Channel n. o.1	S/90=,5 =	60/(1.3×	5,280) = 0.0	00874 41/	1.21
			scharge Co	rie is for	oniles	downstr	cam.
· · · · · · · · · · · · · · · · · · ·			1	409	:		4
•		27	7044	448	16	41727	62304
!			9144	487	12	61430	93662
<u> </u>		36	10 %	525	21	83698	116571
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		<b>!</b>	· · · · · · · · · · · · · · · · · · ·	<i>t</i>			

## ENGINEERING CONSULTANTS, INC.

New	Hampshire	Dom	Safety :	Inspection	<u>'</u> SH	IEET NO	OF
	Vewfound	Lake De	<u> </u>		· · · · · · · · · · · · · · · · · · ·	в NO. <u>/2//</u>	-00/
Dan	Failure	Hydrogr	soh		B)	M.R.H.	DATE 6/29/18
		Stage H.	Area A	Wetted Perimeter W.P.	Hydraulie Padius	ARZYS	9=1.57 AR 4552  Q=1.837 AR 45
<u> </u>				<i>f1.</i>	P. P.		cu. fl. /300.
<del></del> .		0	ø	0.	O	0	0
; ,		4	200	100	.2	3/7	580
——————————————————————————————————————		8	740	185	4	1865	3:430
_		12	1590	265	۷.	5250	9650
, , _ ,	•	16	2720	340	8	10880	19990
	•	20	4100	410	10	19035	34960
		Channel	S/ope, 5	. 80/ (10X	s.280) * 0.0	2152 41/	2'
		n=0.10					
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، سرد در سید		24	5950	4.71	12	20925	5209
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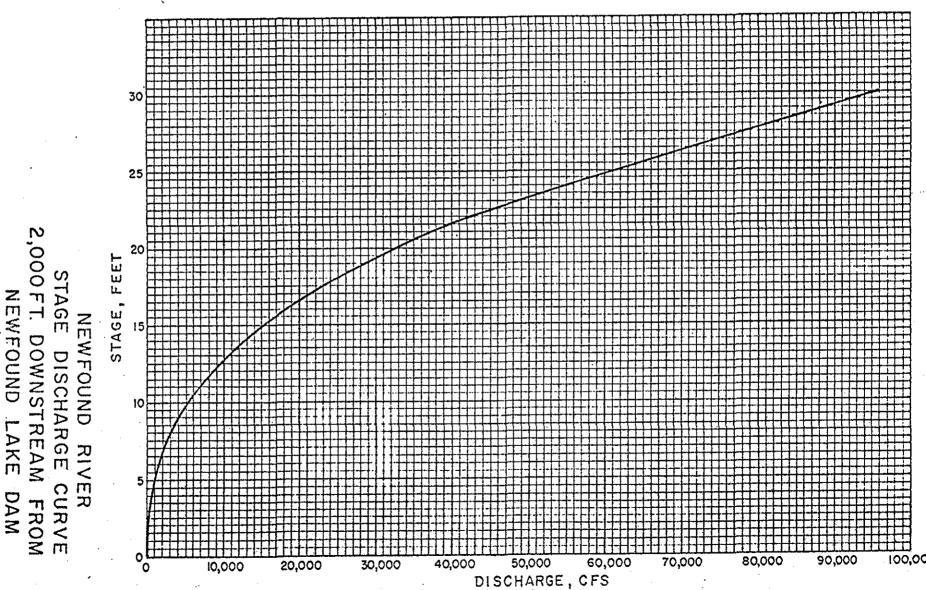
ECI-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHICE DAM SAFETY WELL STON	SHEET NOOF	
NEW TAUXIO I AVE OAN	JOB NO.	
- Street all alleger colour At acres C	200 17 70	

DOWNSTREAM)

ETLAST-DIEWYSHAST DATE DAMETRICALLY FROM DAMETE

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STAGE	AREA A Ca Ti	NELLED MELLED	AYDRAULU R ACIXS R	AP 13	Q=1.49/2 <sup>3</sup>	
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12	1674	222	6	5537	8235	
16	2976	374	. 2	11904	17737	
20	4650	467	10	21578	32159	
24	6582	504	13	36370	54221	
28	8658	541	1/4	54975 64460	81913 96043 115408	
32	10.878	578	19	77455	115,406	-
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MILE DOWNSTREAM
NEWFOUND LAKE STAGE CURVE M FRON M FROM DAM 80,000 90,000 10,000 20,000 30,000 40,000 50,000 70,000 100,000 DISCHARGE, CFS

MILES DOWN
NEWFOUND DISCHARGE CU DOWNSTREAM LAKE 80,000 90,000 100,000 50,000 60,000 70,000 10,000 20,000 30,000 40,000 DISCHARGE, CFS

HEC 1 - COMPUTATIONS

NEW	HAMPSHIRE	DAM SAFE	TY I	NSPECTION	SHEET NO	/OF
	NEW FOU	IND LAKE	DAM		_ JOB NO. <u>/2/</u>	1-001-1
		NPUT TO	HEC-	/	BY HLB	DATE 9-15-

### INPUT TO HEC.

#	ELEV CFT)	HEAD ABOUE SPINWAY CREST CFT.)	YZ STORAGE (AC-FT)	Y3 OiscHARGE (CFS)
. /	588.4	0.	24557	0.
2	(SPINWAY CRES 588.7	0,3.	25500	3/0.
3	589,0	0,5	26800	450.
4	589,5	1.1	29000	675.
5	5 90.0	1.6	31200	780.
6	59211 (TOP OF DAM	3,7	41244	1700.
7	5940	5,6	50500	2800.
8	598.0	9,6	71000	6500-
9	600,0	1116	81684	9100.
10	606.0	17.6	115000	18500,

HILE-1 VERSION DATED JAN 1978

ASSUME SPINDAY CHINCH, 1700

NE WEOUND LAKE DAM

SOR ROUTED OUTSTOR SPINDAY

PINE PAR PAR PAR PAR PAR SOR PAR

93500 46750 1616 5834 12.70 5.30 1116

(117)

2 PROF SOUTH NAVAJO, DEDVER, CO. (1986) 0 36-23

NO

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THE TOTAL PARTICULAR SAFETY INSPECTION - NEW HAMPSHIRE NEWFOUND LAKE DAM PMF FLOOD
                                            JOB SPECIFICATION
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۲.	والمعارض والأعراب المنتقل والرويانات القبيع والمنظران	25	67847.	87890		40.		-		
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#### APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

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